WHEEL LIFT WITH LATERALLY MOVABLE, ROTATABLE SWIVEL ARM WHEEL SCOOPS

RELATED APPLICATIONS

This application is based in part upon my prior application serial number 10/281,508, filed October 28, 2002 which is based upon my provisional patent application serial number 60/347,819, filed October 29, 2001.

FIELD OF THE INVENTION

The present invention provides improvements to the subject matter of my earlier U.S. Patent No. 6,139,250, which encompasses a wheel lift for towing vehicles, wherein the wheels are lifted by a pair of laterally movable and rotatable swivel arm scoops, or claws, as is known in the trade.

BACKGROUND OF THE INVENTION

Motor vehicles, especially front wheel drive automobiles, present problems when being towed. For example, much of the drive machinery and reservoirs are in the front of the vehicle, close to the axle of the front wheels being lifted for towing.

The conventional technology either uses lateral movement of manually engageable claw arms, such as manufactured by Hy-Tech (also known as Hydra-Tech) or uses rotatable swivel arm claws, such as manufactured by Dynamic International Vulcan Equipment Co, Inc., and Jerr-Dan Corporation.

Other prior art includes U.S. Patent No. 4,564,207 of Russ, dated January 14, 1986, which describes a wheel lift

device with rotatable L-shaped swivel arm claws, such as manufactured by Dynamic International, Inc. of Norfolk, Virginia. Furthermore, U.S. Patent No. 5,326,216 also of Russ describes a swivelable wheel scoop, as does U.S. Patent No. 5,722,810 of Young, et al, assigned to Jerr-Dan Corp.

In Russ '207, Russ '626, and Young et al '810, the cross beam does not move laterally perpendicular to the axis of the support beam extending out from the back of the tow truck. Moreover, the swivel arm claws are not tapered to be adjustable for various wheel base widths or for various sized vehicle tires. While the swivel arm claws are pivotable, the piston guiding the swivel arm claw pivoting moves parallel to the axis of the transverse cross bar.

Moreover, U.S. Patent No. 4,473,334 of Brown describes rotatable wheel lift claws, similar to those of Dynamic or Century Wreckers.

U.S. Patent No. 5,692,871 of Nespor, dated December 2, 1997, and assigned to Chevron, Inc. describes a chain movable rotatable swivel arm scoop, wherein the tires of the vehicle are held adjacent to the proximal portion of the swivel arm scoop adjacent to the cross beam. In Nespor '871 the chain moves about a sprocket, and the swivel arm scoops do not move laterally outward and inward parallel to the axis of the cross beam. Nespor '871 does not provide an auxiliary brace to distribute the heavy weight of a towed vehicle against the pivotable swivel arm scoop.

U.S. Patent Nos. 4,929,142 of Nespor describes a tilting vehicle carrier, U.S. patent no. 5,061,147 also of Nespor describes a wheel lift brace, U.S. patent no. 4,927,315 also of Nespor describes a boom retracting device for a wheel lift and U.S. patent no. 5,628,609 also of Nespor shows manually rotatable L-shaped wheel scoops attached to a transverse cross beam.

U.S. Patent Nos. 4,836,737 of Holmes describes a wheel lift tow assembly with manually insertable L-shaped wheel

scoops, U.S. patent no. 4,986,720 also of Holmes describes quick connect wheel cradles with a safety feature to prevent dislodging during towing of a disabled vehicle, and U.S. patent no. 4,679,978 also of Holmes, also describes a wheel lift tow assembly with manually insertable L-shaped wheel scoops.

Other Patents include U.S. Patent No. 4,871,291 of Moore for a wheel lift with manual arm scoops and U.S. patent no. 4,904,146 of Lock also for a wheel lift with manual arm scoops.

U.S. Patent Nos. 3,620,393 of Bubik describes a tow bar assembly, U.S. patent no. 4,637,623 also of Bubik discloses a wheel lift, U.S. patent no. 4,795,303 also of Bubik describes a wheel lift which cradles wheels from below, U.S. patent no. 4,383,807 also of Bubik discloses a wheel lift sling assembly, U.S. patent no. 4,798,509 also of Bubik describes rotatable swivel arm scoops and U.S. patent no. 5,354,167 of Callum discloses underlift mechanisms. Design Patent No. Des. 310,980 describes the exterior design of a towing vehicle body.

Further patents include U.S. Patent Nos. 5,133,633 of Grabba for a flat bed tow truck, U.S. patent no. 5,672,042 of Bartel, which describes a wheel lift assembly, U.S. patent no. 4,239,275 of Horneys for a multi-vehicle tow truck, and U.S. patent no. 5,575,606 of Kiefer which describes a wheel lift with apparently manually rotatable scoop arms.

U.S. Patent No. 4,678,392 of Capers describes a wheel lift with wheel scoops which respond to movement of the wheel upon contact.

U.S. Patent No. 5,518,260 of Grignon discloses a wheel lift with movable jaws, but wherein the vehicle is movable for a short distance within a garage upon rollers.

U.S. Patent No. 4,573,857 of Porter describes a wheel lift with lockable wheel support members.

U.S. Patent No. 4,712,967 discloses a dolly type car carrier and U.S. Patent No. 4,586,866 of Kvamme, describes a wheel lift with manual wheel supports.

U.S. Patent Nos. 4,741,661 of Carey describes manual L-shaped scoop assemblies, U.S. patent no. 5,236,214 of Taylor describes improvements to the boom of an underlift assembly, U.S. patent no. 4,451,193 of Cannon discloses a boom supported wheel lift carrier, U.S. patent no. 5,560,628 of Horn describes a vertically movable towing assembly and U.S. patent no. 5,205,700 of Lin describes a hoist mechanism for a vehicle carrier.

Other patents include U.S. Patent Nos. 5,350,271 of Weller for a wheel lift with swivel arm scoops which are rotatable by the force of cylinders and levers. In Weller '271 the swivel arm scoops are not laterally movable. Moreover, each swivel arm scoop is L-shaped but with no taper to accommodate various wheel sizes. In addition, in a position of rest the cross beam with the swivel arm scoops thereon sticks out from the end of the tow truck, which is a safety hazard.

U.S. patent no. 5,391,044 of Young describes a wheel lift with non-rotatable L-shaped wheel scoops, U.S. patent no. 5,352,083 of Roberts describes a wheel lift with non-rotatable L-shaped scoops having swivelable tire engaging portions, U.S. patent no. 4,384,817 of Peterson describes a frame mounted vehicle lift assembly and U.S. patent no. 4,797,058 of Bilas describes a wheel lift assembly.

Furthermore, U.S. Patent No. 4,632,629 of Kooima describes a wheel lift with laterally movable but otherwise stationary U-shaped wheel scoop jaws. U.S. Patent No. 4,557,496 of Sill, also describes a wheel lift with laterally movable but otherwise stationary U-shaped wheel scoop jaws, and U.S. Patent No. 4,534,579 of Shackleford discloses a wheel lift assembly with pivotable wheel engaging fork members. U.S. Patent No. 4,473,237 of Lind

discloses a wheel lift which includes square shaped members which have to be inserted under the wheels when the vehicle frame is first lifted otherwise.

In addition U.S. Patent Nos. 4,034,873 of Haring describes a sling apparatus with manually installable wheel cradle scoops, U.S. patent no. 3,667,630 of Scott discloses a vehicle tow assembly with lockable wheel engaging members, U.S. patent no. 3,719,294 of Aquilla describes a vehicle tow assembly, U.S. patent no. 4,149,643 of Skala describes a truck tow lift which engages the truck frame, U.S. patent no. 5,607,279 of Hill describes a flat bed tow truck with a hoist mechanism and U.S. patent no. 4,815,915 of Crupi describes an auxiliary tow for a truck which tows a vehicle by engaging its frame.

Moreover, U.S. Patent Nos. 3,434,607 and 3,434,608 of Nelson describe stationary wheel lift assemblies. However the prior art does not describe a wheel lift device having a pair of hydraulically rotatable swivel arm scoops which support the wheels of a disabled vehicle, wherein the swivel arm scoops are also laterally movable parallel to the axis of a cross beam extending transverse to the longitudinal axis of the tow truck itself.

In contrast to the aforementioned prior art, Applicant's U.S. Patent No. 6,139,250 provides cross bar slider arms that automatically move laterally perpendicular to the axis of the support beam extending out from the back of the truck at the same time that tapered wheel lifting swivel arm scoop claws are hydraulically activated.

The present invention improves upon the technology of my issued '250 patent, by addressing the unique problems of towing front wheel drive vehicles, which have complex and sensitive drive machinery and reservoirs near the axle of the front wheels being lifted for towing.

OBJECTS OF THE INVENTION

It is an object of the present invention to provide a wheel lift tow device with a centrally located extendable support beam having a telescoping cross beam pivotably attached to it, so that it can conveniently tow disabled cars, especially front wheel drive motor vehicles.

It is another object to provide a wheel lift tow device with lateral movement for a pair of swivel arm scoops, or claws, which cradle and lift a pair of wheels of the disabled vehicle without damaging drive machinery of a front wheel drive motor vehicle.

It is another object to provide a wheel lift tow device which supports the lateral forces of the wheel while in the cradled position and distributes the weight therefrom, and which strengthens the claws of the swivel arm scoops supporting the weight of the vehicle, by bracketing the claws, which support the weight of the vehicle thereon, and by supplying a resting flange which extends outward below the support arm of the swivel arm scoop claw being supported thereon.

It is another object to provide a wheel lift tow device that protects the movement activators, such as hydraulic cylinders, which automatically move cross bar slider arms laterally while the arms engage a tire sidewall and automatically stop, thus allowing the second cross bar slider arm to extend further and seek out the remaining tire of a non-centered disabled vehicle.

It is yet another object to provide a wheel lift tow device which prevents damage to the oil pan of the disabled vehicle and to the wheel lift device itself.

It is yet another object to provide a wheel lift tow device which accommodates vehicles with various sized wheels and wheelbases, without utilizing portable adapters.

It is yet another object to insure that the swivel arm claw of the wheel lift tow device stays in place while towing a disabled vehicle.

It is yet another object to provide a wheel lift tow device, which accommodates smooth movement in its longitudinal movement away from a tow truck body.

It is yet another object to provide a wheel lift tow device, which enables a tow truck to alternatively use a conventional tow bar with sling and toggle for heavier disabled vehicles when use of a wheel lift is contraindicated.

It is yet a further object to improve over the disadvantages of the prior art.

SUMMARY OF THE INVENTION

In the present invention, a centrally located extendable support beam has a pivotably attached cross bar with telescoping slider arms, so that it can be oriented obliquely for towing obliquely placed disabled cars. The telescoping slider arms of the cross bar provide lateral movement for a pair of swivel arm scoops, or claws, which cradle and lift a pair of wheels of the disabled vehicle.

The swivel arm scoop claws are rotatable about a pivot adjacent to the telescoping swivel arms of the cross bar, but in their position of use are supported by a lateral stop bracket, which supports the lateral forces of the wheel while in the cradled position and distributes the weight therefrom.

The swivel arm claws are powered by movement actuators, such as hydraulic cylinders or other pneumatic or electromechanical actuators, worm gears, etc., as are known to those skilled in the art. The movement actuators are preferably placed forward of the telescoping cross beam, but are protected between upper and lower plates to prevent

damage to the oil pan of the disabled vehicle and to the cylinders themselves.

In a preferred embodiment, the movement actuators are hydraulic cylinders which are fixed in a parallel position preferably one on top of the other, and are enclosed on all four sides by a cover sleeve, as opposed to just upper and lower plates. In addition, an optional hydraulic sensor valve limits tire blowouts by stopping hydraulic fluid flow at a predetermined fluid pressure threshold occurring when the swivel arm contacts against an inflated tire of the disabled vehicle

By "forward" the term means the distal outer portion of the tow device closest to the disabled vehicle. Therefore, the "forward" position is behind the "rearward" position with respect to the actual front of the tow truck. Preferably, to accomplish both lateral and rotatable movement of each swivel arm claw each hydraulic cylinder moves obliquely with respect to the longitudinal axis of the cross bar, to push each swivel arm scoop claw outward as the cylinder rotates each swivel arm claw.

The cross bar swivel pin is a hollow threaded bolt, to facilitate the distribution of grease therebetween.

Alternatively, the hydraulic cylinders can be located rearward of the cross bar, i.e. away from the distal outer position of the tow device closest to the disabled vehicle.

Although the swivel arm claw can be made of straight tubular components to accommodate vehicles with various sized wheels and wheel bases, the distal end member of the V-shaped swivel arm claw is optionally tapered in shape, and extends at a tapered obtuse angle from the proximal end arm of the swivel are scoop claw, which proximal arm is pivotably attached adjacent to the respective telescoping swivel arm of the cross bar. In a further option, a wedge shaped tire adapter sleeve can be placed over the straight, tubular components of the swivel arm claw.

To insure that the swivel arm claw stays in place before being extended laterally out from the central pivot of the cross beam meeting the central support beam coming from the tow truck, a retaining means, such as an internally placed spring, is located within the hollow telescoping swivel arms of the cross bar. Outward extending fasteners, such as nuts, securing the internally placed biasing spring, may be recessed at the ends of the cross bar, to prevent damage to adjacent objects.

Optionally another type of biasing means can be used, such as another hydraulic cylinder.

Furthermore, the hydraulic hose has slack in its position of storage at rest, to accommodate smooth movement of the telescoping support beam in its longitudinal movement away from the tow truck body.

Finally, in a position of rest, the wheel lift mechanism is lifted up by the pivoting of the central support beam, and the swivel arm scoop claws are held at an angle, so that there is a space between them for movement of the conventional telescopic wrecker crane boom extension therebetween. This enables the tow truck to alternatively use a conventional tow bar with sling for heavier disabled vehicles for which use of a wheel lift is contraindicated.

For lifting front wheel drive vehicles with complex drive machinery and reservoirs near the front end axle of the wheels to be lifted, in an alternate embodiment, the pivot point for the movement actuators, such as a pair of hydraulic cylinders, is positioned further rearward with respect to the forward distal end of the lifting swivel arm scoop claws. That is, in conjunction of the definition of "forward" and rearward" as noted before, by "rearward" it is meant that the pivot point is closer to the front of the tow truck and farther away from the "forward" distal end of the wheel lift at the back of the tow truck.

At the same time, a spreader is provided between the laterally moving slider arms of the lifting swivel arm scoop claws and the wheel-accommodating wedge plate, thereby positioned the vehicle more forward (i.e. towards the distal end). This positions the front wheel drive machinery and reservoirs back further away from the moving movement actuators, such as the hydraulic cylinders. A further protection for the hydraulic cylinders themselves is the optional positioning of the cylinders completely within a channel sleeve, covering the front, rear, top and bottom portions of the cylinders, with one or more openings at one end to accommodate movement of the hydraulic cylinders therethrough, or if the cylinders are fixed in place, to accommodate movement of the cylinder piston rod heads within slots of solid plates attached to each respective pivotable movable arm of the swivel arm scoop claws.

To strengthen the load-bearing swivel arm scoop claws, a widened lower resting flange is optionally provided on a stop bracket, stopping movement of the swivel arm scoop claws in the tire-engaging position.

Moreover, to hold the movement actuators, such as the hydraulic cylinders, when not in use, optional brackets, such as crescent shaped eye stop brackets, stabilize the resting position of the swivel arm scoop claws when stored and not in use.

In addition, to accommodate flat tires of a disabled vehicle, a further spreader wedge may be attached to a distal arm of each swivel arm scoop claw opposite to the spreader, thereby reducing the space therebetween.

DESCRIPTION OF THE DRAWINGS

The present invention can best be understood in connection with the accompanying drawings, in which:

Figure 1 is a rear perspective view of a wrecker type vehicle shown with the present invention in a boom up stored travel position;

Figure 2 is rear perspective view as in Figure 1 in a boom down position, wherein the range of motion is shown in phantom of the lateral movements of the wheel pick up elements;

Figure 3 is an exploded perspective view of the components of the wheel lift of the present invention;

Figure 4 is a side elevational view of the hose slack adjuster portion of the present invention;

Figure 5 is a side elevational view of the hose slack adjuster as in Figure 4, shown in an extended position with arrows indicating the direction of extension;

Figure 6 is a top plan view of the wheel lift of the present invention shown in an undeployed position, wherein tires to be engaged are shown in dotted lines for environmental purposes only;

Figure 6A is a top plan view of an alternate embodiment for a wheel lift, shown in an undeployed position, wherein the tires to be engaged are shown in dotted lines for environmental purposes only;

Figure 6B is a local perspective view of a crescent shaped eye stop bracket and open support bracket for stopping and supporting a swivel arm scoop claw alternatively in positions of rest and use;

Figure 6C is a local close-up perspective view of a wider wedge plate for engaging a tire of a disabled vehicle, including a recess provided in the wider wedge plate, which accommodates a recessed fastener attached to an internal lateral tension spring for a swivel arm scoop claw;

Figure 6D is a top plan view of a crossbar and swivel arm scoop claws as in Figures 6A-6C, wherein the cross bar includes a wide U-shaped channel sleeve yoke, enclosing the pivot point for respective hydraulic cylinders, controlling

movement of the swivel arm scoops; Wherein the swivel arm scoops are shown in a storage position of rest;

Figures 6E is a top plan view of the hydraulic cylinder assembly as in Figure 6D, shown in a position of use about a pair of tires of a disabled vehicle;

Figures 6F is an exploded perspective view of the wheel lift as in Figures 6D and 6E.

Figure 6G is an exploded perspective view of a further alternate embodiment for a crossbar and swivel arm scoops, wherein the cross bar includes a wide tubular shaped channel sleeve yoke with windows accommodating the respective hydraulic cylinders controlling movement of the swivel arm scoops.

Figure 6H is a close up perspective detail view of the hydraulic cylinder mounting of the wheel lift embodiment as in Figures 6D-6F;

Figure 6I is a rear elevational view in cross section of the hydraulic cylinder mounting as in Figures 6D-6F; taken along lines "6I-6I" of Figure 6H.

Figure 7 is a top plan view of the wheel lift of the present invention wherein the left swivel arm scoop claw portion is shown pivoting as indicated by the arrows therein;

Figure 8 is a top plan view of the wheel lift of the present invention wherein the left swivel arm scoop claw is shown deployed to the tire and the right portion is shown pivoting before engagement;

Figure 9 is a top plan view showing the left swivel arm scoop claw contacting the tire and the right swivel arm scoop claw contacting the other tire, wherein portable wheel restraint straps are shown in place;

Figure 10 is a close up cross sectional view of the right swivel arm scoop claw contacting a tire, taken along lines "10-10" of Figure 9;

Figures 11, 12, 13, 14, 15 and Figure 16 are close up perspective views of the hydraulic telescopic boom extension, anchor leg and alternate sling set up and deployment thereof;

Figure 17 is a perspective view of a wedge spreader accessory for narrowing the distance between the swivel arm scoop claw and the crossbar, for accommodating a flat tire of a disabled vehicle therebetween;

Figure 18 is a top plan view of a portion of the crossbar and swivel arm scoop claw, with the spreader accessory wedge shown installed on the distal arm of the swivel arm scoop claw, wherein the tire being engaged is shown in dotted lines for environmental purposes only;

Figure 19 is a side elevational view, taken along view lines 19-19 of Figure 18, showing the flat tire engaged by the wider wedge plate, as in Figure 6A and the wedge spreader assembly of Figures 17 and 18;

Figure 20 is a top plan view of a preferred embodiment for a wheel lift mechanism, shown with swivel lifting arms in a position of deployment;

Figure 21 is a diagrammatic top plan view of wheel lift of the alternate embodiment as in Fig. 20, with parallel hydraulic cylinders rigidly fixed to a mounting plate and oriented one on top of the other, and showing a hydraulic diagram showing use of sensor valve to limit claw pressure;

Figure 22 is a front elevational view of the hydraulic cylinders shown in Figure 21, shown oriented one on top of each other; and,

Figure 23 is an exploded perspective view of a tire wedge adapter sleeve insertable over the distal arm of each wheel lifting arm.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows a wrecker truck 1 having the wheel lift mechanism 10 of the present invention which includes a telescoping central support beam, such as probe extension arm 11, slidably attachable to yoke portion 12, wherein yoke portion 12 has extending laterally on both sides wheel lifts 14, 15. Each wheel lift 14 or 15 includes at least one laterally movable telescoping slider arm, such as a pair of laterally movable telescoping slider arms, such as hollow slider arms 16, 17, having extending therefrom a swivel arm scoop claw support, such as open support bracket 18, 19 holding a swivelable arm tire engaging claw, such as pivotable angled claw member 20, 21.

Claw arm members 20, 21 each include a tire engaging portion, such as distal tire plates 22, 23, which are preferably upwardly slanting and basically triangular in configuration. Therefore, the actual angle of each swivel arm scoop claw member 20, 21 does not have a perpendicular "L" shape, but rather an oblique angled shape for securing each claw member 20, 21 underneath each respective vehicle tire of the vehicle to be towed. Each distal tire plate 22, 23 is preferably slanted, wherein proximal portions 20a, 21a of each claw arm number 20, 21 are attached to the laterally movable slider arms, such as hollow slider arms 16, 17, by pins 24, 25, although other fastenings may be used.

The purpose of each claw support, such as claw brackets 18, 19 is to provide further support when each claw arm member 20, 21 is in the extended position engaging with each respective tire of the vehicle to be towed.

Claw members 20, 21 are moved by a force importing mechanism, such as a pair of hydraulic cylinders 27, 28, having piston rods 27a, 28a therein, namely, upper hydraulic cylinder 27, and lower hydraulic cylinder 28, which are basically kept from damage by being placed between

upper and lower cover plates 12a, 12b over yoke 12. Preferably upper cover plate 12a is inserted into cross bar 12d or swivel pad 12e of yoke 12 by a fastener, such as threaded zerked grease fitting swivel bolt 12c, to facilitate rotational movement of wheel lift mechanism 10. Probe extension arm 11 may have attached to it force imparting connectors, such as hydraulic lines 26a, 26b for providing compression for force imparting mechanisms, such as hydraulic cylinders 27, 28.

Hydraulic lines 26a, 26b may have a slackening mechanism as shown in Figures 4 and 5, so that they can smoothly move. Each slackening mechanism includes a pair of pulleys 29a, 29b, wherein one pulley 29a is attached to a coil spring 30, which coil spring 30 is then further attached to extension probe arm 11.

There are further lateral tension members, such as coil springs 31, 32 which are attached within each hollow slider arm 16, 17 of wheel lifts 14, 15, to facilitate the lateral movement of claws arm members 20, 21 and provide tension therewith. Each lateral coil spring 31, 32 is preferably attached by threaded hook 33, 34 to a respective end plates 35, 36 wherein each respective end plate 35, 36 is welded to respective hollow slider arms 16, 17 of wheel lifts 14, 15. Threaded hooks 33, 34 preferably have respective longitudinally extending rods 33a, 34a, which include respective spring retainers 33b, 34b, such as nuts. As shown in the alternate embodiment of Figure 6A and Figure 6C, to protect the tires of the towed vehicle from being damaged by the nut 33b or 34b, while the swivel arm scoop claws 122, 123 are being adjusted to the towing position, fasteners, such as rods 33a, 33b and fastener nuts 33b, 34b, are recessed within respective hollow slider arms 116, 117.

To further hold the tires, each hollow slider arm 16, 17 contains a respective oblique slanted portion 16a, 17a, slanting up from the horizontal, from the ground level, to

the top of each hollow slider arm 16, 17 to prevent forward movement of the tire. Optionally, each oblique slanted portion 16a, 17a can be advanced forward from each hollow slider arm 16, 17 by a spacer (not shown) between same so that yoke portion 12 does not engage an oil pan of the vehicle being towed.

As also shown in Figure 1, probe extension arm 11 is shown in stored travel position. When probe extension arm 11 is lowered to a vehicle engaging position as in Figure 2, claw arm members 20, 21 are rotated as indicated by the arrows "A", "B". Furthermore, yoke 12 is pivotably movable clockwise or counter clockwise, as indicated by arrow "C", to facilitate oblique mounting of a set of vehicle tires upon wheel lifts 14, 15.

Figure 2 also shows directional arrow "D" to indicate the linear "in and out" movement of probe extension arm 11, to move wheel lifts 14, 15 underneath the tires of a vehicle to be towed. Figure 2 also shows directional arrows "E" to indicate the lateral sideways "in and out" movement of hollow slider arms 16, 17.

Figures 6-9 show the movement of claw arm members 20, 21, wherein swivel arm scoop claw arm members 20, 21 are first pivoted and then moved in place against the tire.

Figures 7 and 8 further show piston rods 27a, 28a of hydraulic cylinders 27 and 28, each movable independent of each other so that respective distal tire plates 22 and 23 of respective swivel arm scoop claw members 20 and 21, engage respective tires of the disabled vehicle.

As also shown in Figure 8, hydraulic cylinder piston rods 27a and 28a can stop independent of each other when each hydraulic cylinder piston rod 27a or 28a engages a respective tire of the disabled vehicle, as the respective telescoping slider arms 16, 17 move laterally outward. This results in the disparate extension lengths of hydraulic cylinder piston rods 27a, 28a shown in Figure 8.

As shown in Figure 9, the safety straps are manually applied for additional safety.

In Figure 11 there is shown hydraulic telescopic wrecker crane boom extension 38 for vehicle retrieving purposes. When wrecker crane boom extension 38 is used, then wheel lift apparatus 1 can be lowered in its vertical stored position to the ground, so that the anchor plate at a rear portion of probe extension arm 11 contacts and anchors to the ground for stability.

Even as claw arm members 20, 21 are stored vertically in the retracted position, as in Figure 1, then boom extension 38 can move freely therebetween.

In Figure 12-16 there is shown an alternate sling apparatus 37 supported by a conventional telescopic wrecker crane boom extension extending upward for the tow truck body of tow truck 1 attached to the truck vehicle 1 which can be used for heavier lifts with a conventional hook up.

Figures 14 and 15 show the further details close up views of the sling deployment mechanism. Sling apparatus 37 attached to the deck of the vehicle 1 by attaching winch cable 40. By partially extending wrecking crane boom 38 between and through stored swivel arm scoop claw arm members 20, 21, winch cable 40 can then be attached to tow sling apparatus 37 normally stored on the wrecker body deck.

In Figure 14, 15 by partially releasing the tension lock pin 41, one arm of the sling apparatus 37 will be released and freely extended to opposite bracket 42, without wheel lift apparatus obstructing the use of the sling apparatus 37.

In the alternate embodiment of Figure 6A, wheel lift apparatus 110 operates in a similar configuration and manner as wheel lift apparatus 10 of Figure 6. For example, central support beam 111 supports cross bar 112 at a distal end thereof. Each wheel lift swivel arm scoop such as claws 114 and 115, includes at least one laterally movable telescoping

slider arm, such as slider arms 116, 117, having extended therefrom respective wheel lifting swivel arm scoops 114, 115. As shown in Figures 6A and 6B "J" or "V" shaped claws 122, 123 of swivel arm scoops 114, 115 pivot from respective open support brackets 118, 119.

Figures 6A and 6B show lower flange extensions on open support brackets 118, 119, which extend outward more than the upper flange of open support brackets 118, 119 to give additional load support to the claw arms of swivel arm scoops 114, 115.

Figures 6A and 6B also show eye stop brackets 137, 138; such as for example, of arcuate shapes, which stop and stabilize swivel arm scoops 114, 115 in place in a storage position of rest against portions of telescopic crossbar arms 116, 117.

To move the disabled vehicle farther away from moving actuators 127, 128, such as hydraulic cylinders, slanted wheel-engaging surfaces 116a, 117a of telescopic slider arms 116, 117 are wider than wheel engaging surfaces 16a, 17a shown in the embodiment of Figure 6. Figure 6A also shows power sources 126a, 126b, such as hydraulic fluid lines, for hydraulic cylinders 127, 128.

While Figure 6A shows wider wheel engaging surfaces 116a, 117a, in a further alternate embodiment shown in Figure 6C, spreader blocks 116b and 117b separate telescoping slider arms 116, 117 from slanted wheel-engaging surfaces 116a, 117a. This moves the wheels of the vehicle and thus its front wheel drive machinery, further away from moving movement actuators 127, 128, such as hydraulic cylinders.

In yet another embodiment for separating the movement actuators away from the front wheel drive machinery of the vehicle being towed, as shown in Figure 6D and 6E, the pivot point of movement actuators 227, 228 is located inward away

from the vehicle to a more inward pivot point "P" away from the location of the pivot point as in Figure 6.

In order to further protect the cylinders 227, 228 in Figure 6D, 6E and 6F, they are covered by a wide channel sleeve yoke 212. Yoke 212 has top and bottom surfaces connected by a common rear wall.

Figures 6D, 6E, 6F, 6H and 6I further shows hydraulic cylinders 227, 228 pivoting about pin 230 extending through channel sleeve yoke 212 of Figure 6D. Pin 230 extends through upper and lower wall 212a, 212b of yoke 212, bearing plates 231, 232 extending there from, and through joint blocks 227a, 228a of hydraulic cylinders 227, 228. Flat washer 233 separates joint blocks 227a and 228a and shines them against bearing plates 231, 232.

Yoke 212 may have other configurations, as in Figure 6G, such as with a square tubular configuration 312 with windows 312a, 312b for accommodating movement of cylinders 327, 328 therethrough, as long as yoke 312 permits movement of both telescopic arms 316, 317 and of hydraulic cylinders 327, 328 or other movement actuators.

Figures 17-19 shows a wedge adapter sleeve 124 which slides over each claw arm 122,or 123 of swivel arm scoops 114, or 115, to provide a space and reduce the distance between the claw arms 122, 123 and slider arms 116 or 117, where small tires or flat tires are being lifted.

As shown in Figures 20-23, in an alternate embodiment of wheel lift 80 of this invention, hydraulic cylinders 90 and 84, which operate left claw 82 and right claw 83 respectively, are rigidly attached to yoke 12 via one or more brackets 98. Cylinders 90 and 84 operate from a fixed position, with pistons extending therefrom. Cylinders 90 and 84 are positioned parallel to each other, and one cylinder is positioned above the other cylinder, as shown in Figure 22.

For protection of the cylinders and hydraulic lines, these hydraulic cylinders are covered by a cover sleeve 88 which covers them on all four sides (top, bottom, front and rear), and isolates them from external damage. Because cylinders 90 and 84 are covered, the moving pistons 91 and 85 do not come in contact with any sensitive part of the undercarriage of the disabled vehicle about to be towed.

To facilitate driving while lacking the pivoting action of the moving cylinders of the previous embodiment shown in Figures 3, 6, 6A, 6D, 6E, 6F, 6G, 6H, 6I, 7, 8 and 9, each cylinder 84 and 90 now drives arm 83a and 82a respectively through attached slotted drive plates 86 and 92 respectively.

As a result, both the inner arms 83a and 82a, as well as outer distal arms 83b and 82b, are moved in and out of their wheel lifting deployed positions.

Slots 86a and 92a of drive plates 86 and 92 can be linear, extending in a straight line, curved, extending in an arcuate curve, or a combination thereof. In this manner, piston rod 85 of hydraulic cylinder 84 terminates in a rod end coupler, which can slide in the slot 86a of drive plate 86, which is welded to arm 83a.

Similarly, piston rod 91 of hydraulic cylinder 90 also terminates in a rod end coupler, which couples to the slot 92a of drive plate 92, which is welded to arm 82a.

Wheel lifting claw 82 is shown in its fully deployed position in contact with the disabled vehicle wheel. The position of rod 91 end is shown at the top of the slot 92a of drive plate 92.

When right claw 83 and left claw 82 are in their fully retracted positions, such as described in Figure 1 now the ends of rods 85 and 91 of hydraulic cylinder 84 and 90 would be at the lower end of the respective slots 86a and 92a in plates 86 and 92.

The slots 86a and 92a introduce the degree of freedom required to enable the drive hydraulic cylinders 84 and 90 to be rigidly attached instead of pivoting about each other, as in Figure 6 herein.

Figure 21 also shows the addition of ~~a~~ pressure limiting sensor valves 115 and 115a in respective hydraulic fluid flow lines, which limits the force of ~~a~~ each claw member against each lifted tire of a disabled vehicle wheel. This avoids any possibility of tire damage or blow-out.

In Figure 21, claw member cylinder 90, with piston rod 91, is driven via hydraulic lines 116 and 117. To extend piston rod 91, hydraulic fluid line 116 is pressurized while hydraulic fluid line 117 is used as the return line, expelling hydraulic fluid from the front of the piston within hydraulic cylinder 90. Piston rod 91 is retracted by pressurizing hydraulic fluid line 117, while using hydraulic fluid line 116 as the return line, expelling fluid from the back of the piston rod 91 within cylinder 90.

Sensor valve 115 is normally closed, but it senses the pressure at hydraulic fluid line 116. In the extension process of piston rod 91, pressure at line hydraulic fluid 116 will rise rapidly as the wheel lifting claw 83 presses against the vehicle tire.

At the factory-determined setpoint of valve 115, it opens, thereby leaking fluid directly from hydraulic fluid line 116 to hydraulic fluid line 117 (via path 120) thereby limiting pressure build-up at hydraulic fluid line 116.

Since the force of the wheel lifting claw member 82 against the tire is directly related to this pressure, this too is thereby limited to a safe value. Valve 115 again closes when the pressure is reduced below the setpoint.

A similar situation exists for moving wheel lifting claw member 83. Claw member cylinder 84, with piston rod 85, is driven via hydraulic fluid lines 116a and 117a. To extend rod 85, line 116a is pressurized while line 117a is used as

the return line, expelling fluid from the front of the piston within cylinder 84. Rod 85 is retracted by pressurizing hydraulic fluid line 117a while using hydraulic fluid line 116a as the return line, expelling fluid from the back of the piston 85 within cylinder 84.

Sensor valve 115a is normally closed, but it senses the pressure at hydraulic fluid line 116a. In the extension process of rod 85, pressure at hydraulic fluid line 116a will rise rapidly, as the claw presses against the vehicle tire.

At the factory-determined setpoint of valve 115a, it opens thereby leaking fluid directly from line 116a to line 117a (via path 120a) thereby limiting pressure build-up at line 116a.

Likewise, since the force of the claw member 83 against the tire is directly related to this pressure, this too is thereby limited to a safe value. Valve 115a again closes when the pressure is reduced below the setpoint.

In addition as shown in Figure 23, for tires of varying sizes, respective tire wedge adapter sleeves 87 are insertable over the outer distal arms 83b and 82b of wheel lifting claws 82 and 83. Wedge adapter sleeve 87 includes a hollow insertion sleeve, generally of square cross section, adjacent to a slanted ramp, to decrease the area accommodating the tire therein.

In the foregoing description, certain terms and visual depictions are used to illustrate the preferred embodiment. However, no unnecessary limitations are to be construed by the terms used or illustrations depicted, beyond what is shown in the prior art, since the terms and illustrations are exemplary only, and are not meant to limit the scope of the present invention.

It is further known that other modifications may be made to the present invention, without departing the scope of the invention.

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